

REMARKS

Claims 1-16 and 26 are pending after entry of this Proposed Amendment. Claims 27-31 are canceled in accordance with Applicants' election, with traverse, of claims 1-16 and 26 for prosecution. No additional claim amendments are herein submitted.

Applicants herein resubmit claims 1-16 and 26, without amendment, to verify and reassert the claims being examined and prosecuted. Applicants respectfully submit the Office erred in the Final Office Action with the advisement that the application as originally filed contained only claims 1-23. The present application as originally filed on February 16, 2001, contained a copy of the originally submitted parent application, 09/346,156, filed on June 30, 1999, and containing originally presented claims 1-25. By Preliminary Amendment, filed concurrently with the present application which is a Continuation of application 09/346,156, Applicants amended claims 1 and 10, canceled claims 17-25, and submitted new claims 26-31. Examiner is kindly directed to page 24 of the specification as filed, which contains claims 24 and 25 as originally filed. Applicants therefore submit that the claim numbering as indicated and followed by both the Office and by Applicants prior to the Final Office Action is correct, and Applicants are herein continuing use of this claim numbering.

Applicants are filing this response within two months of the date of mailing of the Final Office Action in conformance with MPEP Section 714.13. A response in accordance with this section is kindly requested.

Rejections under 35 U.S.C. §112

Claims 1-16 and 26 were rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Applicants respectfully traverse this rejection and request reconsideration.

Applicants herein resubmit comment and argument submitted in response to paper No. 6. The asserted §112 rejection is maintained by the Office from the rejection asserted in paper No. 6.

The Office asserts that the phrase, "the inorganic dielectric layer being highly selective relative to the barrier when etched" (emphasis supplied by the Examiner) in Applicants' independent claim 1 renders the claim indefinite. It is further asserted that it

is not clear “what will be etched when etched” and that “highly selective relative to” is a relative term which renders the claim indefinite (Final Office Action, paragraph 2).

Highly selective is a descriptive term that is well known and understood in the art. Generally, selectivity refers to a ratio of etch rates of different layers or materials. See *Silicon Processing for the VLSI Era, Vol. 1 -- Process Technology*, by S. Wolf and R. N. Tauber, Lattice Press, 1986, at pages 523-528.

In the cited phrase, Applicants have drafted the claim to recite the method operation as forming an inorganic dielectric layer to define a via dielectric layer over the barrier layer, and have further defined the inorganic dielectric layer as being highly selective relative to the barrier layer when etched. As is known, selectivity is generally a ratio of etch rates of different layers or materials, and Applicants have in the cited phrase from claim 1 recited the layers as the inorganic dielectric layer and the barrier layer. Applicants have also specified that the selectivity is in reference to an etching operation.

Therefore, Applicants have identified specific layers as an inorganic dielectric layer and a barrier layer, and a specific process is identified, but not claimed, as etching. The inorganic dielectric layer is identified as highly selective to another layer, the barrier layer. The inorganic dielectric layer is highly selective to the barrier layer when the inorganic dielectric layer is etched. Applicants submit this is clearly recited in the claim, and contrary to the Response to Arguments in the Final Office Action, there is no ambiguity regarding “what will be etched when “when etched,” that the phrase is understood by one of ordinary skill in the art, and that the phrase does not render the claim indefinite.

Applicants further submit that the specification does identify standards for ascertaining the requisite degree, although one of ordinary skill in the art would appreciate the degree required to render the inorganic dielectric layer highly selective to a barrier or any other layer. The Examiner is kindly directed to page 2 of the specification as filed, lines 20-22 where excellent selectivities are identified as in a range of about 20:1. Additionally, a poor selectivity is identified on page 3, line 6, as nearing about 5:1. In describing embodiments of the present invention, Applicants recite at page 12, line 22 – page 13, line 1, that selectivities to the barrier layer 102 can range up to about 20:1 using the exemplary chemistry.

The Final Office Action again further submits that the phrase “when etched” is not a positively cited limitation and carries no patent weight. Applicants respectfully submit that “when etched” is recited to clearly identify the process giving rise to the

selectivity. Although etching might appear to be the obvious process giving rise to the selectivity in the context of claim 1, Applicants have positively identified the process. Applicants would further submit that etching, as a process step, is not a claimed limitation in claim 1. Examiner is directed to claims 2 and 3 in which a trench is formed using a first etch chemistry, and a via is formed using a second etch chemistry.

In the Final Office Action, the Examiner maintains that the term “a low dielectric constant layer” is a relative term which renders the claim indefinite. The Final Office Action restates that the term “low dielectric constant” is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Applicants again respectfully traverse each characterization of the term “low dielectric constant,” and request reconsideration.

The terms “low dielectric constant,” and “low dielectric constant layer” are well known and understood by one of ordinary skill in the art. Applicants, however, have defined the term within the specification as filed. Examiner is directed to page 2, lines 7-8, where one example of a “lower dielectric material” is identified as having a dielectric constant of about 3.0 or lower. The Examiner is further directed to page 11, lines 8-16 where the Applicants have specifically recited the trench dielectric layer 106 is a low k (“k” or “K” used to denote dielectric constant) dielectric layer with a dielectric constant of below about 3, with a specific example of C-oxide as being low k, having a dielectric constant of about 3.0 or lower. Therefore, Applicants respectfully submit that, in addition to being known and understood by one of ordinary skill in the art, the Applicants have defined the term “low k dielectric,” which is also known as a low dielectric constant dielectric, as about 3.0 or lower, and have done so in several passages in the specification as filed. See, for example, page 2, lines 6-8, page 11, lines 6-16, page 15, lines 13-15, page 16, lines 5-7, etc.

Applicants further direct Examiner to prior art submitted and cited in the examination of the present invention for the frequent use of and manipulation of low k dielectric materials, further indicating the term is well known by one of ordinary skill in the art at the time of invention.

Claims 2, 6-7, 10, 13, and 14 were again specifically rejected for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention citing the asserted indefinite quality of the term “low dielectric constant

layer.” Applicants again respectfully submit that the term is well known in addition to being described in the specification as filed, and resubmits the argument set forth above.

For at least the above reasons, Applicants respectfully submit that the term “low dielectric constant layer” is defined in the specification as well as being known and understood by one of ordinary skill in the art. Applicants further point out that the term “low dielectric constant” is also denoted as “low k” in the specification. Applicants respectfully request reconsideration of the §112 rejections.

Rejections under 35 U.S.C. §102

Applicants herein resubmit comment and argument submitted in response to paper No. 6. The asserted §102 rejections are maintained by the Office from the rejections asserted in paper No. 6. Applicants further point out that each of the §102 rejections is prefaced with the phrase: “*****Notice: this rejection is based on the scope of using ‘a low dielectric constant layer’ as a name of a dielectric layer to define a trench.***” Applicants respectfully submit, and argue below, that a low dielectric constant layer is more than a name of a layer to define a trench. Low dielectric constant defines qualities and characteristics of a dielectric, and are thus positively recited features of the claims of the present invention. Further, due to the specific nature of the rejections premised on the characterization of “low dielectric constant layer” as nothing more than a name of a dielectric layer to define a trench and without independent qualities or characteristics, Applicants are restricted in response to the rejections to those grounds for rejection as asserted by the Office.

Claims 1-3, 7-8, 10, and 14 were rejected under 35 U.S.C. §102(e) as being anticipated by Jain (U.S. Patent No. 5,821,168). This rejection is respectfully traversed.

Jain teaches a structure that includes four discrete insulating films (Col. 3, lines 3-4, Figure 3). The lower or first film is a barrier layer 48 made of plasma enhanced nitride. This barrier layer 48 is covered with a second film which is an oxide layer 26. The oxide layer 26 is covered by a third film which is an optional etch stop layer made of silicon oxynitride 50. The silicon oxynitride 50 layer has a thickness in the range of 200-700 Angstroms (Col. 3, lines 13-15). The fourth film is another oxide layer 54.

Jain teaches that the second and fourth films, the oxide layers, can be formed using tetraethylorthosilicate (TEOS), silicon oxyfluoride, low k dielectrics, or the like (Col 3, lines 15-17). Jain teaches two low dielectric constant layers.

In pending independent claims 1 and 10, Applicants are claiming a low dielectric constant trench layer over an inorganic dielectric via layer (specified as a silicon dioxide layer in independent claim 10). Thus, Applicants specifically claim at least a low dielectric constant layer over an inorganic dielectric layer, and the low dielectric constant layer is a trench layer and the inorganic dielectric layer is a via layer. Jain, on the other hand, teaches a low dielectric constant trench layer over a low dielectric constant via layer. *Fig 1a-2*

Jain, therefore, fails to teach each and every element of Applicants' independent claims 1 and 10. Applicants respectfully request that the §102 rejection be withdrawn. The dependent claims, including dependent claims 2, 3, and 14, depending directly or indirectly from independent claims 1 and 10 are submitted to be patentable over the cited reference for at least the same reasons.

Claims 1-5, 10-14 and 26 (according to the claim numbering as discussed above) were rejected under 35 U.S.C. §102(e) as being anticipated by Smith (U.S. Patent No. 6,277,733). Applicants traverse this rejection and request reconsideration.

Smith teaches an electronic device and methods for fabricating the same on a semiconductor wafer. While Smith teaches a plurality of layers to the disclosed device, of particular relevance to the presently claimed invention is a via layer, identified in the Smith reference as 424, and a trench layer, identified in the Smith reference as 430. As noted in the Smith reference at col. 3, lines 26-28, "dielectric layer 424 (preferably comprised of FSG, BPSG, PSG, TEOS, aerogel, xerogel, HSQ or any other low dielectric constant material)" is a low dielectric constant layer. The reference states at col. 3, lines 55-59, that "dielectric layer 430 is comprised of TEOS, FSG, PBSG, PSG, HSQ, or a low dielectric constant material, such as aerogel, xerogel, or a polymer (such as fluorinated parylene)." Dielectric layer 430 therefore can be fabricated of the named materials, *or* a low dielectric constant, *or* a polymer. Smith, therefore, teaches a trench layer which can be of a number of materials including a low dielectric constant material, over a via layer of a low dielectric constant material.

The present invention claims a low dielectric constant trench layer over an inorganic dielectric via layer. The reference teaches a low dielectric constant (among other materials) trench layer over a low dielectric constant via layer. The reference does not teach each and every feature of Applicants' independent claims 1 and 10. Applicants respectfully request that the §102 rejection be withdrawn. The dependent claims

depending directly or indirectly from independent claims 1 and 10 are submitted to be patentable over the cited reference for at least the same reasons.

Claims 1-4 and 10-16 were rejected under 35 U.S.C. §102(e) as being anticipated by Wang et al. (U.S. Patent No. 6,255,735, hereinafter Wang '735). Applicants traverse this rejection and request reconsideration.

Wang '735 teach a structure similar to Smith and Jain which includes a low k dielectric trench layer over a low k dielectric constant via layer. Wang '735 does not teach a low k dielectric trench layer over an inorganic dielectric via layer. Wang '735 therefore does not teach each and every feature of the claimed invention. Applicants respectfully request this rejection be withdrawn.

Claims 1-4 and 10-16 were rejected under 35 U.S.C. §102(e) as being anticipated by Wang et al. (U.S. Patent No. 6,207,577, hereinafter Wang '577). Applicants traverse this rejection and request reconsideration.

Wang '577 teaches a similar structure to Wang '735, in that Wang '577 teaches a low dielectric constant trench layer over an oxide via layer. Wang '577 does not teach a low dielectric constant trench layer over an inorganic dielectric via layer. Wang '577, therefore, does not teach each and every feature of Applicants' claimed invention, and Applicants request the §102 rejection be withdrawn.

Rejections under 35 U.S.C. § 103


Claims 4-9, 15-16, and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Jain, Smith, Wang '735, and Wang '577 as applied to claims 1 or 10 above, in further view of Usami (U.S. Patent No. 6,077,574). Applicants respectfully traverse this rejection and request reconsideration.

If Applicants correctly understand the rejection, the Office is rejecting only dependent claims 4-9, 15-16, and 26 under §103, and on the basis of independent claims 1 and 10 having been rejected under §102 over the cited references as discussed above. Therefore, no §103 rejection has issued against independent claims 1 and 10. As Applicants have argued above in detail, the cited references fail to teach each and every feature of Applicants' independent claims 1 and 10, and Applicants' independent claims 1 and 10 are patentable over the cited art under §102. Independent claims 1 and 10 do not stand rejected under §103, and are therefore patentable under §103 over the cited art. Applicant therefore submits that dependent claims 4-9, 15-16, and 26, each of which depends ultimately from one of independent claims 1 and 10, are likewise patentable over

the cited art under §103, and Applicants respectfully request the §103 rejections be withdrawn.

In view of the foregoing, Applicants respectfully request reconsideration of claims 1-16 and 26, and submit that these claims are in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. If Examiner has any questions concerning the present Amendment, the Examiner is kindly requested to contact the undersigned at (408) 749-6900, ext. 6905. If any additional fees are due in connection with filing this amendment, the Commissioner is also authorized to charge Deposit Account No. 50-0805 (Order No. LAM1P106A). A copy of the transmittal is enclosed for this purpose.

Respectfully submitted,
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